CHAPTER 7

The Prospects for Biological War in the Middle East

Brad Roberts

Introduction

The proliferation of biological weapons to states in the Middle East has raised questions about whether, when, and how such weapons might be used there.[1] In the absence of systematic investigation of these questions, different views have taken hold in different parts of the Washington policy community. Among defense planners there is a broad-based belief that likelihood of use is high, largely on the view that their military utility is potentially very high—especially for asymmetric conflicts against the United States. Among country and regional experts there is broad-based skepticism that such weapons will ever be used, largely on the view that such weapons are unproven historically and too risky in terms of the harsh responses they might generate. A third view is sometimes expressed among political-military analysts: that such use is likely only in last resort in an effort to assure regime survival—on the model of potential Iraqi BW use against the Desert Storm coalition, as it has come to be understood subsequently.

Because these different expectations have fundamentally different implications for U.S. policy, in the military realm and elsewhere, it is important to look beyond these conventional wisdoms to develop deeper insights into the prospects for the use of biological weapons in the region. This paper is aimed at providing answers to a number of key questions:

- How might biological weapons be used in conflicts in the Middle East over the next decade?

- How probable is such use?
- By what rationales might certain types of targets be selected and concepts of operations (CONOPS) elaborated?
- What use scenarios stand out as of highest potential impact?[2]

The best answers to the questions noted above would come from definitive information from within decision-making circles in these countries. What plans have they made for the use of biological weapons? What infrastructure have they put in place? What doctrine have they written and authorized? How do they understand the risks of escalation, deterrence, and counter-deterrence? But definitive information is sorely lacking.

The absence of hard data on the BW topic reinforces the skepticism of those who believe proliferation will not lead to the use of biological weapons. They conclude that scientific and/or technical factors may be shaping BW programs in the region much more so than strategic imperatives. In elaborating this conclusion, they sometimes draw on the experience of the biological weapons producers of the interwar and early cold war years—when weapons were developed, produced, and stockpiled in secret R&D programs that were at best loosely connected to the military operator, who wrote requirements and fielded and trained with new capabilities.[3] Even the experience of the United States is illustrative here: during the period that it had an offensive biological warfare program, it developed limited BW CONOPS but barely integrated such attacks into war plans.

But the absence of hard data on this topic is hardly reassuring. Because these weapons are the object of an international treaty regime—to which many of the states in the Middle East are party[4]—there are political costs associated with publicly describing an extant but illicit capability. There also are costs in terms of the responses of neighbors who might be compelled to create a retaliatory force of their own. Furthermore, the facilities associated with the development and production of biological weapons are notoriously difficult intelligence targets. Moreover, in the last decade a great deal has been learned about the biological warfare activities of at least three states—Iraq, Soviet Union/Russia, and South Africa—and in each case new insights have revealed a level of interest,

scale of activity, and degree of sophistication in each country's BW activities that had not been expected. In trying to frame these issues, we must also ward against the opposing tendency—in the absence of hard information to inflate a threat. The fact that many states in the region may have an interest in biological weapons does not necessarily imply that each has succeeded in mastering all of the scientific, engineering, doctrinal, and other challenges associated with their effective use in war, and has also put together the entire infrastructure from preliminary research to deliverable weapons to do so.

One approach to the basic questions posed above is to explore the motivations that drove decision-makers in the region to acquire a BW capability.[5] Such an approach can provide valuable insights into decision-maker mindsets and their perceptions of the potential political utility of biological weapons. But the motivations to acquire may prove rather different from the motivations to use. Strategic circumstances may have changed, new needs arisen, new understandings of the technical possibilities for BW emerged through greater familiarity, or new perspectives developed as a result of wars or other crises in the region, etc. Accordingly, it is necessary to explore *motivations to use* as a topic separate and distinct from *motivations to acquire*. The two approaches can provide complementary insights.

Another approach, often used in the defense planning community, is to argue from the technical characteristics of biological weapons about their likely military applications in the regions. This approach can provide insights into perceptions of the likely operational utility of biological weapons. Such perceptions seem likely to span the full spectrum, from a view of biological weapons as unreliable on the battlefield and hence of low military utility, to a view of such weapons as promise special and indeed unique capabilities for specific types of missions.[6] Here too a complementary approach is useful, combining technical and motivational assessments. Thinking through the technical characteristics of such weapons in combination with motivations to use them may lead to an understanding of potential uses other than those that might have been expected based on motivations to acquire—novel uses derived from an advanced understanding of the scientific and technical potentialities associated with the use of biological weapons.

In the absence of hard data, this must be a speculative task, drawing on inferences from past experience and underlying technical factors. If that speculation is to offer real insights into the key questions, it must also be systematic. Rather than begin with the question "how might biological weapons be used in the region?" this paper begins with a prior question: what types of conflicts are likely in the region? This enables a more focused review of the interests motivating the conflicts and how those interests might shape the propensity to use biological weapons. The timeframe here is the decade 2001-2010. The focus is not limited just to known or suspected possessors of biological weapons; indeed, it is reasonable to assume that all actors in the region can acquire biological weapons if they so choose. Moreover, for this survey of conflict potentials, consideration is given to both state and non-state actors. The core insights we are seeking here relate to state actors, and that is where the conclusions will focus. But the overlapping patterns of violence between, within, and among states are a striking feature of the region.

This paper begins with a series of propositions about the patterns of conflict likely to be seen in the region over the coming decade. The resulting taxonomy is then used to develop some propositions about the likelihood of the use of biological weapons by state and non-state actors. Two scenarios are then selected for more in-depth analysis. This analysis elaborates the strategic logic that could lead to the use of biological weapons, including especially the perceived potential benefits and risks of such weapons relative to the other assets, conventional and non-conventional, within the actor's reach. It concludes with a brief review of key insights.

A Conflict Taxonomy

The Middle East is obviously rife with conflict. The history of conflict between states in the region is as old as the existence of the states themselves, as they have juggled for advantage over one another, acquired or contested territory, or fought foreign invaders. Internal conflicts are also as old as the states, given the broad absence of stable institutions of governance. But a close survey of this history suggests that the

unrestrained use of violence in the region is exceedingly rare. The use of violence is instrumental in nature, and employed by rational actors seeking specific tactical gains or political ends. Understanding those ends is key to understanding the motivations potentially driving the use of biological weapons. To be sure, there are also instances in which that use is more atavistic in nature, driven, for example, by a desire for revenge.

Looking ahead the next decade or so, the following propositions about conflict in the region appear to be generally accepted among regional experts.[7] This acceptance does not, of course, imply that these propositions can be a fully reliable tool of prediction, given the well-demonstrated capacity of actors in the region to behave in unexpected ways. But they should be useful in defining the scope of the relevant possibilities.

> (1) Wars between states in the region involving the large-scale use of force, and perceived to be calling into question survival of the regime or state, are unlikely in this time frame. This includes large interstate wars analogous to the Iran-Iraq conflict of the 1980s, that pitted two well-armed countries against each other for many years in a war of mass casualties and attrition. Saddam Hussein's ambitions for Kuwait remain unrequited, but for the moment at least the conditions are not right for a repeat attempt to conquer his neighbor. The collapse of the Israeli-Palestinian peace process raises a question for many about whether a new drift of events may be unfolding, with a slope toward major war. Such a war could bring Arab states again into confrontation with Israel, which could well pose—or be seen by Israelis to pose—an existential threat to it.
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> (2) Less unlikely are limited interstate wars for limited terms and limited ends, not raising questions of regime or state survival. No one would rule out border or other disputes between Iran and Afghanistan, Syria and Turkey, or even Turkey and Greece, for example. A replay of Iran-Iraq on a more limited basis is also conceivable.

(3) An act of aggression by one state against another that brings about conflict with the United States and a U.S.-led coalition is also a possibility. Iranian military coercion of the Gulf Cooperation Council (GCC) countries, an Iranian attempt to disrupt or close the strait, or a Libyan attack on Egypt (among others), are considered of moderate likelihood. Iraqi aggression against Kuwait or some other neighbor is generally rated a somewhat higher likelihood.

(4) Low-intensity conflicts raising questions of regime legitimacy and survival will continue and may intensify. Possibilities include armed opposition to governments in Iraq and Iran, and anti-regime Islamic movements in Algeria, Bahrain, Egypt, Jordan, Syria, and Turkey. The apparent demise of the peace process between Israel and the Palestinian Authority is perhaps the stand-out problem here, bringing with it an intensification of violence and new questions about the tactics necessary in a new phase of confrontation, although renewed conflict here could be transformed into a major interstate conflict as suggested in (1) above if neighboring states are drawn in.

(5) Some regimes will attempt to violently and ruthlessly suppress such conflicts. Iraqi suppression of the Kurds in the 1980s is a model that may be followed elsewhere. Examples of concern include Iran, Yemen, and Syria.

(6) As peace processes continue in various venues, splinter groups will emerge to militantly oppose a peace deal. Those groups typically seek to escalate the conflict in order to derail the deal and/or to exact revenge. Multiple possibilities exist: Hamas, Hizbollah, or perhaps radicalized Israeli settlers.

(7) State support for terrorism outside the region will continue much as before. States in the region have a long history of the use of covert action to accomplish short- or long-term aims within and beyond the region. The U.S. government has recognized Iran, Iraq, Libya, Sudan, and Syria as state sponsors of terrorism.

(8) Transnational terrorism such as that initiated by Al Qaeda on 11 September 2001, will not disappear from the region, nor will it supplant other forms of sub-state and interstate violence. Such terrorism is employed in service of a revolutionary agenda aimed at expelling Western and especially U.S. influence from the region, and at installing regimes of an acceptable type. Whether it will grow over the decade is an open question. Its growth may be inhibited by the interests of states in the region in avoiding retaliation. The dramatic U.S. and world response to Al Qaeda after the September 11th attacks may also serve to discourage some terrorist adventurism in the future. Although most transnational terrorism is apparently not state sponsored, in some instances it is state tolerated.

(9) States and regimes will continue to place high value on weapons of mass destruction (WMD) as a coin of power—for their political as much as for their military utility.[8] Such weapons are valued by different regimes for different purposes: whether to compensate for conventional weakness, to otherwise restore a balance of power of some kind, to press a demand for a seat at the negotiating table, to coerce or compel one's neighbors and other potential adversaries, or more generally to compel the outside world to pay attention to local concerns. The prestige value of WMD is as much internal as international for some of these countries. Possession of WMD, whether actual or only rumored, can help to reinforce the legitimacy of a ruling faction within the larger elite.

The taxonomy in Table 1 may not exhaust all of the conflict potentialities in the region, but it encompasses most of the important factors and trends.

Likelihood	**Conflict Potentialities to 2010**
Higher	low-intensity anti-regime domestic repression by regime state sponsored terrorism transnational terrorism political exploitation of WMD peace process splinter groups
⇕	asymmetric warfare against a U.S.-led coalition limited interstate wars for limited ends

Table 1

Rating BW Likelihood

What does the taxonomy shown in Table 1 offer in the way of insights into the questions associated with the use of biological weapons? It helps to link questions of use with questions of strategic intent. It offers a vehicle for considering whether the most likely conflicts in the region are also the conflicts most likely to see the use of biological weapons.

The logic that would lead to the use of biological weapons seems clearly to be missing in a couple of the conflict potentialities described above. In anti-regime, low-intensity conflicts, the use of biological weapons seems quite unlikely. The violent Islamic and other oppositionist movements of concern here are seeking to mobilize public support, to cast existing governments as illegitimate, and generally to create the political conditions that enable them to emerge as successors to the regimes they are attacking. The use of biological weapons could run counter to these interests.[9] The use of a banned weapon—especially its use to generate broad suffering among civilians—could de-legitimize these movements in the eyes of their intended domestic supporters, and perhaps internationally as well. Some groups depend substantially on international support, such as the

groups supporting Palestinian and Kurdish statehood. This may be less true of those Islamic groups that have claimed a holy writ for their chosen tactics. Moreover, in many if not all of the countries where such movements are a concern, there is a significant measure of external, usually covert, meddling; the meddling states have interests that could be damaged if BW use were to result in international condemnation, sanctions, and even military action. A disturbing footnote to this analysis relates to the potential utility of biological weapons for attacks not on humans but on plants and animals; anti-regime actors could potentially find such attacks useful for destabilizing a country without unduly risking a punishing reply and perhaps without alienating excessively the target state's human population.[10] Again, this may be less true of some of the Islamic groups, who perceive a strong base of support among those who are politically and economically disenfranchised.

The use of biological weapons for catastrophic effect in border skirmishes and other limited interstate wars also appears to be of low likelihood. Because these are by definition limited wars for limited gains, the use of a weapon of mass destruction would appear to offer few benefits and many risks. Such weapons might be seen as useful for clearing out contested areas of unprotected civilians, especially if they can be used without detection or attribution. From a military perspective, the benefits would likely be limited to possible defeat of the adversary's military forces (assuming effective BW use, in conjunction with other factors, including a conventional ability to exploit whatever advantages might be created by the use of unconventional weapons). The risks could be prompt retaliation by the neighboring state and a spiraling escalation process, as well as a sharp international reaction associated with violating a global treaty and norm. Successful surreptitious attacks would pose fewer such risks.

Some experts believe that an especially sharp reaction to any use of BW is expected in the region. Their argument runs as follows: the failure of the United Nations Security Council to reply in any meaningful way to Iraqi use of chemical weapons in the 1980s precipitated a sudden burst of WMD proliferation in this region, as elsewhere. In order to prevent a similar burst of proliferation in the

wake of the next use of biological weapons, and in part as compensation for their failure to respond decisively to Iraqi chemical weapons (CW) use, the Council may wish to make a demonstration with its response.[11] Whether the expectation is well founded is an open question; but to some degree the expectation does appear to reflect the thinking of decision-makers in some states in the region about the international repercussions of the use of biological weapons for anything but the most compelling purposes of self defense in extremis, or regime survival.

At the opposite extreme, in some conflicts in the taxonomy the use of biological weapons appears to be a realistic possibility—indeed, the likelihood might well be high.

A large interstate war invoking questions of the survival of the state or regime would seem likely to see the use of unconventional weapons of whatever type are available to the regime in question.[12] Such weapons might be used only late in the conflict, in strategies aimed at ensuring the survival of the regime—threatened, and perhaps used, as weapons of last resort. It is also conceivable, however, that decision-makers in one or more capitals might conclude that the decisive advantages of such weapons must be reaped early rather than late in any conflict, so as to gain the upper hand in the military confrontation and thus leverage over the end game. The user's risk, of course, would be in generating reprisal and retaliation by the opposing side. This is a risk that is especially pronounced in the BW area, as a victim state could presumably produce retaliatory quantities of weapons in a relatively short period of time. Thus, the first-user would have to expect that early use would decisively terminate the war on favorable terms and eliminate the possibility of counterescalation by the opposing side.

Splinter groups deeply opposed to an emerging peace settlement also seem likely to be interested in biological weapons as a way to destroy the political willingness on one or both sides to make a deal; they might be used to punish their enemies when leaders choose not to, as they make peace; or they might be used to exact revenge against those who would make such a deal.[13] Precisely because biological weapons have not been utilized by politically motivated terrorist

groups in their strategies to gain a seat at the table, and legitimacy for their cause, they may be seen as useful by the splinter groups for signaling an escalation of risk and a break with the past to a qualitatively new form of violence. In the Israeli-Palestinian context, the rumored interest of certain segments of Hamas in acquiring chemical weapons is matched by the rumored willingness of Israel to exploit biotechnical and other means to poison its adversaries—perceptions on both sides that may well have weakened the taboo on the use of such weapons within the region.

The use of biological weapons in asymmetric strategies against U.S.-led coalitions also appears likely. Aggressors might see multiple roles for biological weapons in such conflicts, including coercion of the United States and its local allies/partners, warfighting, escalation, and war termination.[14] This subject is explored in greater detail below.

It should be noted that both types of BW use would constitute a significant break from past practice in the region. The fact that terrorists have so far refrained from the use of non-conventional weapons to achieve their aims is striking—just as states have so far refrained from using them to achieve war aims against superior military adversaries. Terrorist restraint in this regard probably has both technical and political explanations. From a technical point of view, they have not benefited from access to the WMD programs of the state sponsors of terrorism and those few who have been interested in BW apparently have had to master the technical challenges on their own. Those challenges are modest when it comes to the production of bacteriological materials, but are more substantial when it comes to effective storage and delivery of the agents. Moreover, a successful BW terrorist attack would require mastery of multiple skill sets associated with agent selection and production, "weaponization," target selection, training, self protection, attack operations, and escape.[15]

Technical factors thus may account in part for terrorist restraint in the use of BW but would not appear to be fully satisfactory as a reason for terrorist non-use. Thus, it is important also to consider political factors. Terrorist restraint in this regard would appear also to derive from the need to calibrate the use of violence so that it is sufficient to gain attention to a cause and, at the same time, not excessive, in a way

that would damage their legitimacy and alienate important constituencies.[16] On asymmetric warfare, the restraint is more difficult to characterize, but would appear to derive from the fact that, within the region, weapons of mass destruction have been understood largely to play a role in deterrence and not operational military art.

Thus, one further "use" must be seen as of potentially high likelihood—the political use of weapons of mass destruction. Such use is already well demonstrated in the region. Saddam Hussein regularly touts his supposed victory in the Persian Gulf War and the ostensible role of biological weapons in preventing the Desert Storm coalition from pressing on to remove him from power. BW capabilities are also spoken of as counters to the nuclear power of states in the region—whether implicitly as a deterrent or explicitly as a capability to be used in retaliation.[17]

This leaves a set of potential conflicts where the role of biological weapons cannot easily be written off, nor can it be predicted as especially likely.

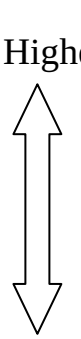
Transnational terrorists have exhibited a strong interest in mass casualty techniques. This has most recently been demonstrated by the Al Qaeda hijacking of four U.S. airliners on 11 September 2001, and ramming them into the Pentagon and two towers of the World Trade Center. Such terrorists are not constrained in the way that traditional terrorist actors have been by the need to calibrate their use of violence. Osama bin Laden has deemed the acquisition of weapons of mass destruction to be a "holy duty."[18] The collateral effects their use would produce could have been seen by bin Laden not as alienating or de-legitimizing, but as useful, demonstrating that the U.S. regime in power cannot protect its people. There may also be a particular appeal to biological weapons derived from the special abhorrence they generate; within the region there is a tradition of combating foreign invaders with weapons and tactics that are especially offensive to those invaders. The purpose of choosing such especially offensive techniques is to communicate social rage against that invader. It is also to generate fear, as the invader must contemplate the barbarity of those faced by overwhelming conventional military power. Osama bin Laden also reflects the revolutionary's desire to use violence to raise

the stakes in a game that he wants to see accelerate and intensify.[19] In his case, he might also have been attempting to get the U.S. to strike back in such a way as to alienate and further radicalize the Muslim world, triggering an even wider holy war.

State-supported terrorism outside the region also falls in the middle category. Historically, states have had many good reasons to be restrained in assisting the terrorists they support to master the techniques of mass casualty warfare.[20] Many of the state sponsors of terrorism are also understood to be possessors of chemical and/or biological weapons, yet none is understood to have opened the CBW arsenal to the terrorist camps. That restraint evidently has something to do with the fear of retribution—as with the technical difficulties and unpredictability of their effects. Looking to the future, the question is how much restraint will they continue to exhibit in this area? They may come to be persuaded that BW attacks are plausibly deniable and thus run little risk of being tracked back to the sponsor. They also may develop techniques for the use of BW for purposes other than mass casualties—perhaps only to sicken in large numbers, with the hope of turning local political will against the United States, for example.

Finally, the use of biological weapons for the purpose of suppressing domestic opposition cannot be ruled out. Indeed, there is a long history in the region, as elsewhere, of the use of poisons to eliminate enemies. Moreover, there is obviously the model provided by Saddam's attack on the Kurds with CW (and allegations that BW was used as well),[21] and the apparent development of a BW agent (aflatoxin) in part for the purpose of waging long-term, covert war against the Kurds. This points to the possible use of biological weapons to exterminate hated groups, especially where they are far from international disease monitoring, or perhaps to deprive them of food and other resources. Here, revelations about the techniques developed by the former apartheid government of South Africa for long-term attack on the black population may prove a stimulus.

Likelihood of Use of Biological Weapons



by peace process splinter groups
in asymmetric warfare against a U.S.-led coalition
political exploitation of WMD
in large interstate wars of survival

by transnational terrorists
by state sponsored terrorists
by regime for domestic repression

in limited interstate wars for limited ends
in low intensity anti-regime violence

Table 2

Table 2 provides a summary of this discussion of the likelihood of the use of biological weapons in the contingencies identified in the preceding section. Probabilities are expressed in relative and not absolute terms. Absolute predictions are a near impossibility in so complex and volatile a region—and without knowing what is in the hearts, minds, and war plans of decision-makers there. On an absolute scale, it would seem unwarranted to interpret the higher likelihood contingencies as having a high certainty of BW use—but the possibility is plausible and by strategic logic serious. At the other end of the spectrum, interpreting the lower likelihood contingencies as being those in which it is possible to rule out the use of BW would also seem unwarranted. For reasons noted above, the technology of biological warfare may be evolving in ways as to make such uses seem tempting.

Probing More Deeply

This framework of analysis provides some answers to the questions about where and why biological weapons might be used in the region. To consider how they might be used requires exploring specific scenarios in

more detail. For this purpose, two are selected here. One is the canonical major theater war problem, in which a local BW-armed aggressor confronts a U.S.-led coalition. The other is a major interstate war calling into question regime legitimacy and survival. The former is rated a high likelihood in the preceding assessment. The latter is rated a lower likelihood, but is not ruled out. A replay of the Iran-Iraq conflict, but in a 2005 timeframe, is selected on the argument that, because these two countries have been at work on biological weapons for such a long time, the scenario may be suggestive of the range of possible future utilities of BW for local actors.

The Canonical Major Theater War

How might a BW-armed regional aggressor use biological weapons to commit and secure that aggression, and to cope with the political-military consequences of a U.S. effort to reverse that aggression? To answer this question requires an understanding of how the aggressor's strategic risk assessment will change during the course of such a war—and of the perceived utility of different military instruments in his tool kit to secure his interests.[22]

Prior to an act of aggression, the enemy leadership is likely to find it useful to isolate the United States to the maximum extent possible in the hope that this will deny it allies, partners, basing rights, etc., in the conflict to come. This could entail destabilizing countries with which Washington might hope to affiliate itself, through the use of proxy groups and domestic terrorism. For this end, as argued above, biological weapons may not look particularly useful. Traditional instruments are well proven and generally effective. The risk that BW may be used for this purpose may be rising, however, if such weapons are understood to offer the possibility of mass casualty attacks with plausible deniability. Moreover, biotechnical developments may make such weapons more easily usable and predictable in their results.

Once the aggressor acts, his primary goal would be to achieve a militarily decisive *fait accompli* prior to outside intervention. This would present the United States and its allies and partners with a difficult choice between attempting to reverse the aggression at potentially high cost, and acquiescing. For this purpose, there would be both incentives and disincentives to the use of BW by the aggressor.

The incentives might include the following. If the aggressor perceives biological weapons to be potentially significant in the conflict, early use may well be seen as more strategically effective than later use. Low lethality attacks on military targets that also spare major population centers may be seen as especially useful in gaining that decisive *fait accompli*. Such weapons could be seen as useful if the aggression is being undertaken against an adversary with superior conventional warfighting capabilities—or the capability to mobilize them quickly. In this case, likely targets would be in the adversary's depth, with the purpose of slowing his capability to mobilize.

The disincentives might include the following. Such use might be seen as increasing the odds that Washington would deem it necessary to respond to the aggression. There might also be concerns about the international backlash that could damage the political prospects for the regime and perhaps direct aid to the victims of the aggression. If an aggressor were to prefer to rely on conventional means for the purposes of achieving a *fait accompli*, it seems unlikely that he would choose to risk the use of BW solely on a selective basis to achieve his war aims.

Whether or not the effort to achieve a *fait accompli* succeeds, once having acted the aggressor will have an interest in dissuading formation of a coalition around U.S. leadership and thereby isolating the United States. The aggressor might hope that such isolation would be militarily crippling to the effort to reverse its aggression, by denying U.S. intervention forces crucial bases of operation and logistic support. He might also hope that it would be politically crippling, by sowing debate in Washington and especially the Congress about whether the United States genuinely has an interest in intervening in a crisis where locals in the region apparently prefer not to act. In pursuit of such dissuasion, the aggressor would want to inflict some punishment on neighboring civilians—enough to generate fear of more to come, but not enough to make acceptance of the aggression politically impossible. Biological weapons might be seen as too risky for this purpose, given their reputed uncontrollability. But given that they can be used covertly and in plausibly deniable ways, the risk may be seen as worth running.

If the aggressor fails to dissuade coalition formation (or a U.S. decision to act unilaterally), then its interest is in deterring the coalition (or the United States alone) from taking military action, thereby securing the

aggression. The deterrent effect of available conventional weapons would not seem particularly compelling. Nuclear weapons could conceivably seem especially useful for this purpose. Biological weapons may well be perceived as closer to nuclear than conventional weapons for this deterrent purpose, because of their potential for generating mass casualties among both military personnel and civilian host populations. But again, the aggressor must be concerned with calibrating the use of violence to generate the desired effect (in this case, restraint by Washington and its partners) and not undesired ones (a backlash to his excessive force that casts the aggressor as a dire menace to the region, to be removed from power at all costs). Accordingly, if biological weapons were to be used for this deterrence purpose, it would seem that they might be used on a limited basis against civilian targets so that there is great fear of more suffering to come. U.S. diplomatic personnel in the region would seem lucrative targets, as well as other symbols of American society, such as business interests. Conceivably, the aggressor might also selectively target civilians in Europe, believing that America's NATO allies would pressure Washington to terminate the conflict on available terms so as to end their suffering.

If deterrence fails, the aggressor's interest shifts yet again—to crippling the intervention in its early phases in order to prevent the coalition from exploiting its full military potential and conventional advantages and thus to create a prolonged stalemate and a basis upon which to negotiate an outcome that protects some or all of the aggressor's gains. For this purpose, chemical and biological weapons may well have a perceived utility that conventional weapons would not. CBW attack on air- and sea-ports of debarkation, logistic centers, prepositioned equipment, and other host nation support assets could seem particularly beneficial in slowing the arrival of U.S. forces and inhibiting their ability to gather themselves into a coherent fighting force. A creative adversary might reach out of the theater in the attempt to cripple the force flow, with covert, special forces attacks on ports of embarkation in the United States. Such uses of BW would run a very substantial risk from the adversary's point of view: the possible expansion of war aims by the United States and/or its allies to include regime removal. This risk may be especially pronounced if the aggressor attempts to use biological weapons for limited gains but, miscalculating the lethality and effectiveness of his weapons,

ends up killing far in excess of the intended numbers. But this risk might not be meaningful to the aggressor as he may have concluded that such a confrontation would necessarily entail questions of regime survival. This seems most likely if there were to be a replay of the confrontation between Iraq and the United States: Saddam Hussein would have to contemplate the likelihood that in a renewed war, Washington could not again settle for his remaining in power.

If through these means the aggressor is not able to cripple the intervention and the United States is able ultimately to bring its full conventional power to bear, then the aggressor has an interest in inflicting operational defeat on the coalition's in-theater forces and denying it any advantages of escalation. If the aggressor believes he can do so by conventional means alone, he may well see BW attacks as too risky in terms of generating a nuclear reply from the United States (or perhaps another nuclear-armed coalition partner). But, given the balance of conventional forces in the region, and the apparent capability of the United States to defeat any regional adversary if given the time to assemble a force and the capability to fight on its preferred terms, then a conventional victory seems unlikely to be seen as viable by the aggressor. The temptation to escalate would be obvious. It might not seem prudent, given the potential for the United States to counter with a nuclear reply. But a nuclear counter may be discounted by the aggressor on the argument that no act of his so far would warrant the taking of millions of lives by the United States—and Washington's breaking the nuclear taboo. Thus a prediction of the likelihood of BW use at this point cannot be made confidently. If the aggressor possessed nuclear weapons of his own, the temptation to use BW might be rather high. On the other hand, such use could be held in reserve as an escalation option in the hope of dissuading Washington from seeking regime removal as a condition of war termination.

If the aggressor fails to defeat the coalition and prevent it from escalating, his interests shift yet again: to preventing battlefield defeat from becoming strategic defeat in terms of dismemberment of the military, occupation of the country, and/or removal of the aggressor regime by the coalition. At this phase, the aggressor would want to be seen as capable of inflicting very high pain on members of the coalition that press for such strategic defeat. He would want to be able to threaten a "spasm" of attack

on civilians among the coalition nations, including the United States.[23] For this purpose, it would seem that missile-delivered weapons of mass destruction could have unique appeal. But if confronted with the need to make good on a threat, which weapon might be seen as the most likely to produce the desired result without generating a backlash? A nuclear attack in this late phase of war would seem highly likely to generate a nuclear reply. Effectively delivered chemical or biological attacks could be seen as offering the leverage necessary to accept the aggressor's offer of "peace," but as far less likely to generate a nuclear reply. On the other hand, the very slowness of their effects would likely be seen as unacceptable in a rapidly unfolding geopolitical crisis.

The conflict dynamics in this war termination phase are a matter of substantial speculation.[24] One possibility is presented in the history of Nazi Germany and Hitler's virtual embrace of the punishment meted out to Germany by the invading powers as just punishment of a people who had failed in creating the thousand-year Reich. By this analogy, a regional aggressor might employ mass casualty BW attacks in the late phases of a war, fully aware of the reprisal to come, but seeing it as a price to be paid for the failure of some grand ambition. Another possibility is presented by those instances in history when professional military leaders chose not to carry out their leader's dictate to take actions tantamount to national suicide. By this analogy, the regime may be motivated to escalate, but the military may be unwilling to do so. It is noteworthy in this regard that in World War II, Germany did not use its chemical weapons in the final endgame, just as Japan did not use its biological weapons.

A final phase must be considered. If the original aggression is reversed, the military is hobbled, and the country loses some measure of sovereignty but the regime escapes the war intact, then the regime's goals would be (1) to prevent a consolidation of regional forces detrimental to its interests, and perhaps (2) to exact revenge against those within and beyond the region (and perhaps domestically) who fought against it. A weak, collapsing regime might be particularly motivated to exact such revenge. For these purposes, biological weapons could be seen as particularly useful, especially given the capability to employ them covertly.

These strategic imperatives for the U.S. adversary, as they evolve through the phases of confrontation, are summarized in Table 3.

Adversary Strategic Imperatives in Major Theater War Against U.S.
Prior to an act of aggression, to isolate the United States and destabilize its allies/partners.
Once war begins, to achieve a militarily decisive *fait accompli.*
To dissuade formation of a coalition around U.S. leadership.
To deter any coalition (or the United States alone) from undertaking military action to reverse the aggression.
To cripple any such U.S. intervention in its early phases.
To inflict operational defeat on the coalition's in-theater military forces.
To prevent battlefield defeat from becoming strategic defeat in terms of dismemberment of the military, occupation of the country, and/or removal of the regime.
To prevent consolidation of regional forces detrimental to the regime's interests, while exacting revenge against those who fought against it.

Table 3

In sum, in this canonical major theater war scenario, the BW CONOPS an adversary might implement seem likely to be conditioned by the phase of war. At each phase, a specific set of interests is at play, against which questions of risk and benefit will be measured. In some phases, biological weapons seem likely to be perceived as too risky or as not sufficiently promising in their results, at least relative to other conventional or unconventional weapons. In other phases, their perceived relative utility could be quite high, and the risks seen as manageable. There is little agreement within the expert community about whether the early use of biological weapons would be seen as strategically valuable; some believe that such use would be unnecessarily provocative of the United States, whereas others believe that aggressors would see the benefits of early use to be irresistible. There is also little agreement within the expert community about the likelihood of use later in such a war, in the war termination phase. Some look to the Persian Gulf war experience and

conclude that biological weapons would have been very useful to Saddam Hussein in preventing the coalition from seeking removal of his regime. Others, drawing on other experience in the region, argue that even in the war termination phase, such use is unlikely, as it would make it nearly impossible for the United States to settle for a conclusion to the war that leaves the regime in power.

Given these different motivations to use biological weapons at different phases of conflict, possible CONOPS are necessarily varied as well. When the aggressor's interest in dissuasion and deterrence are most at play, the optimal uses of BW are likely to be selective, surreptitious, and focused on civilians, with the hint of more pain to come. When the aggressor's interests are more operational, the optimal uses are likely to be tied to targets of high campaign significance, such as ports and airfields, and logistic centers (and medical infrastructure), or to deploying forces themselves. The character of BW use, in terms of the type of agent and target selected and the extent of use, would vary according to the phase of war. Only in the war termination phase, when regime survival is most directly at stake, does it seem likely that the aggressor would consider the highest-damage BW attacks on population centers, though even those may look unacceptably risky given the potential for reprisal and retaliation.

Renewed Iran-Iraq War in 2005

A second scenario that provides insight into how regional actors might actually employ biological weapons involves a renewed war between Iran and Iraq. Such renewal cannot be ruled out—both sides exhibit a pattern of miscalculation and the old issues between them, such as who will dominate the other and who will control the Gulf, have not been resolved. If such a war were to erupt in 2005, what interests and strategic concepts would guide decisions about when, where, and how to use biological weapons?

As neither side used biological weapons in the war in the 1980s, a necessary point of departure is consideration of what might have changed since then. This analysis reviews four main factors bearing on this question:

- Lessons of the war of the 1980s, both generally and specifically, as they relate to unconventional weapons.
- Lessons of subsequent wars, especially the Persian Gulf War and Kosovo.
- Implications of international developments.
- The changing domestic context in both countries, as it bears on war planning and war-making.[25]

The lessons of the war of the 1980s most relevant to the question of future use of BW include the following. The primary lesson stems from the failure of the international community to respond in any significant way to the use of chemical weapons in that war. Though deemed morally repugnant and banned by the Geneva Protocol, the use of such weapons brought no punishment to Iraq; the chief lesson must be that circumstances other than use, such as who initiated the war and who is winning, will be at least as important, if not more so, than the use of banned weapons. At least two other lessons may shape future propensities to use BW. First, chemical weapons were shown to be tactically effective but not strategically decisive. Second, means to reliably attack key strategic assets such as oil fields, ports, and air bases would have been very useful—but were lacking.

Following these lessons, one can understand why biological weapons might seem attractive to one or both sides. They appear to offer high shock value against civilian targets and broad area coverage of strategic assets. It would appear, moreover, that their use would not entail a significant risk of punishment by the UN Security Council or other interested parties. A particularly scheming aggressor might also think that he can use biological weapons surreptitiously on his own people so that it appears that the adversary used them first—and so that his own use can be justified internationally as in retaliation.

The lessons of subsequent wars may be equally important. The Persian Gulf war taught military leaders in the Middle East at least three important lessons of concern to this BW assessment. First, the Soviet approach to war, with its heavy reliance on armored forces and detailed planning, was shown to be defunct. Second, most countries in the region

appeared unable to master maneuver warfare and combined arms operations, given the absence of the necessary technical skills in their soldiers. Third, conventional militaries failed against high-tech forces. The Kosovo war reinforced the lesson that old military approaches are defunct and that countries without nuclear, biological, or chemical weapons are readily man-handled by U.S.-led coalitions with superior conventional military capabilities. The net result is a widespread perception in the region that traditional militaries can start a war, but cannot fight on to win against most of their most likely adversaries.

The Persian Gulf war also left a perception that one can avoid U.S. nuclear retaliation if one stays below some ill-defined U.S. threshold. Some regional experts believe that biological weapons are not seen to be clearly above that threshold. Deployment of active and passive defenses by the United States may also be seen as raising the perceived threshold. Many regional experts are also skeptical of the view that Saddam Hussein's behavior in the Persian Gulf war suggests that biological weapons will be used in the region only as he subsequently suggested they might—to prevent losing wars from becoming wars of regime survival through the promised last-resort use of biological weapons to ensure regime survival. Many regional experts interviewed for this study do not subscribe to this view and dismiss Saddam's statements about last resort BW CONOPS as strategic deception.

Thus the lessons of these wars have reinforced a broad interest in the region in novel techniques, asymmetric strategies, and "special weapons."

Multiple international developments are likely to have an impact on whether and how biological weapons are used in a renewed Iran-Iraq war. Chief among these is the shrinkage of the international arms market brought about by the collapse of the Soviet Union, the end of the Cold War, and shifts in the global economy. Neither Iran nor Iraq can expect to enjoy large and continuing transfers of conventional weapons in a renewed war, and will have to find other means to avert or cope with a limited war that unexpectedly becomes a war of attrition. The UN's failure to eliminate Iraqi WMD also has a significant implication for Iran, signaling that it may well be left to its own means to deal with those WMD. The fact that biological weapons have turned out to be the most difficult of Iraq's WMD for the UN Security Council to resolve can only reinforce the importance of such weapons in Iran. Nuclear proliferation in South Asia,

and the failure of the UN Security Council to prevent it or roll it back, reinforces the perception that the major powers are paper tigers—and also that nuclear weapons are likely to play a significant long-term role in the regional balance of power. This may reinforce the perception of WMD as a useful and necessary strategic coin of power, one that can be had over the objections of even the most powerful states. Moreover, accelerated cooperation among WMD proliferators on third- and fourth-generation capabilities, missile and otherwise, points to the possible elaboration of alternative approaches to chemical and biological warfare, approaches involving novel agents and novel CONOPS.

Finally, the changing domestic context in both countries would likely have an impact on future war between them. Both Iran and Iraq are today far poorer than they were two decades ago. Oil wealth was squandered in war and sanctions have kept both poor. Neither can relish a long-term war of attrition. Both will worry about the effects of the lifting of sanctions on the other. Both have greatly reduced conventional military capabilities compared to two decades ago. Iraq has lost its strength in artillery, so decisive in the 1980s. Both have, at best, modest arsenals of ballistic missiles with limited targeting capability, incapable of sustained salvo wars. This reinforces the urgency of gaining maximum early shock in any city-busting warfare. The militaries in the two countries face major questions about their capability to fight a prolonged war under modern, high-tech conditions with appropriate doctrine, training, and leadership; it would appear, however, that Iraq might be expected to quickly regain some advantages in this regard if sanctions were lifted on the two countries. Lastly, there are some important domestic political changes: Iraq can no longer credibly aspire to leadership of the entire Arab world (though it can still drag along and embarrass some of those neighbors who would prefer not to follow it). Iran no longer exports a radical ideology. Thus, both may believe that a limited war will not invoke questions of regime survival (at least at the start).

Thus, it would appear to be the case that both sides would value quick victory so as to avoid a war of attrition, as well as some means to more effectively wage a war of the cities so as to bring about the strategic decisions by the adversary that they desire. Biological weapons may be seen in both Baghdad and Tehran as useful for both these purposes, especially relative to the other military assets that are available.

Conventional means appear unpromising for anything other than a limited engagement of limited intensity. Conventionally tipped ballistic missiles appear unpromising for the war of the cities. Chemical weapons may be seen as tactically useful, but not reliably strategically significant. Nuclear weapons may either be unavailable (not least because of the difficulty of producing them covertly, in contrast to biological weapons) or too risky to use. Thus, there could be strong interest in biological weapons.[26]

A final additional factor must be considered—in the 1980s, neither country possessed an operational biological warfare capability. Today, both do. The very existence of BW arsenals may help to answer a question posed earlier in this section—how might these states find themselves back in such a war? One side may be emboldened to undertake provocative action on the argument that the existence of the WMD deterrent ensures that the opposing side would not escalate in response. This is an important argument derived from the nuclear experience in South Asia, where the presence of nuclear weapons is understood to have emboldened Pakistani leadership in 1999 to adopt a more assertive posture on the Kashmir issue, on the assumption that India would be frozen from replying by the mutual deterrent. This suggests the possibility of war renewed by one side on the premise that biological weapons would keep it limited.

Conclusions

Let us return to the four opening questions:

1. How might biological weapons be used in conflicts in the Middle East over the next decade?
2. How probable is such use?
3. By what rationales might certain types of targets be selected and concepts of operations (CONOPS) elaborated?
4. What use scenarios stand out as of highest potential impact?

An answer to the first question requires an understanding of the types of conflicts that might occur in the region and the political, military, and

strategic interests they have for the actors. Not all of the many conflict potentialities in the region present high risk of biological weapons use. Especially in low intensity conflicts and where the use of force is for limited purposes, the use of biological weapons seems likely to be seen as counterproductive. Moreover, it may be seen as unnecessary, as other means are available. Furthermore, many of the regimes in the region have relatively weak control and have consistently shown an unwillingness to employ techniques over which they might lose control, and which could be turned back on them. This is an argument to stay with what works.

But there is also a reasonably plausible spectrum of contingencies where the use of biological weapons could look necessary and prudent to the actor. These generally fall within the realm of coercion, deterrence, escalation, and punishment in conflicts where the stakes are relatively high, especially stakes of regime survival. Here the argument must be: don't stay with what you know, because it won't work.

How probable is such use? There is a strong argument that the probability of use is increasing. Most countries have proven incapable of combined arms operations and would not, in any case, be able to provide for the extended resupply of large conventional wars. They have no confidence in their capability to compete militarily against higher-tech conventional forces. So there is rising interest in asymmetric strategies and "special weapons."

To argue that the probability of use is increasing is to make a statement about relative likelihood. What about on an absolute scale? This is far more difficult to gauge. Recall from the introduction the different perceptions of likelihood held by defense planners (who tend to see adversary BW use as inevitable) and country and regional experts (who are highly skeptical of this view). This analysis suggests that both are wrong and that the truth lies in the middle: BW is a likely future condition of conflict but by no means a certainty.

Happily, the most likely conflicts in the region are not the types of conflict where the likelihood of BW use would be rated as high. The most likely conflicts involve non-state actors or sub-state groups; the interstate wars that are possible do not appear particularly likely, except perhaps those employing limited means for limited ends. But the "political uses" of biological weapons—whether overtly brandished or quietly rumored—

for purposes of reinforcing a regime's stature (and generating fear of it) are already in evidence and promise to become more so in the decade ahead.

From the U.S. point of view, the most important question of probability relates to attack on its own forces and interests with BW. This is seen as probable in a canonical major theater war scenario. The principal shortcoming of this canonical model of a future major theater war is its clear similarity to a past war—the war to expel Iraq from Kuwait. There appear to be relatively few plausible possibilities within this region, and outside it, for a replay of such a war, unless of course Iraq concludes that a replay of such a war—but this time with a robust BW capability—would deny the U.S. local coalition partners and would give Washington strong reason not to seek to intervene in the first place. In Northeast Asia, there is the important possibility of a war on the Korean peninsula, which could play out along lines very similar to those sketched out above. But in the Middle East, given the relatively low likelihood of interstate war involving state and regime survival issues, this canonical scenario may be quite unlikely in the decade ahead. To the extent it is a real possibility, it would appear to stem from Iraq. But a replay of the Iraqi invasion of Kuwait and of the coalition expulsion of Iraq could not be expected to unfold in directly parallel fashion to the previous conflict. Both sides would have learned lessons. Iraq presumably would not initiate such a war unless it intended to pursue its asymmetric advantages to the maximum extent possible. But Saddam Hussein, or a similar successor regime, would also have to conclude, as noted above, that neither Washington nor his immediate neighbors could again accept an outcome that leaves him in power: thus regime survival would be at stake from the start. These factors point to a very high-risk strategy by Iraq, one aimed at maximizing shock for his neighbors and maximizing fear among decision-makers in Washington and elsewhere. Accordingly, the early and heavy use of biological weapons may be more likely in a replay of the canonical scenario than in the original.

By what rationales might certain types of targets be selected and CONOPS elaborated? There can be no simple answer to this question. Those rationales derive from the interests at stake in a conflict, as they change during the course of the conflict. They derive also from the actor's understanding of the potential benefits and risks associated with different types of use for different purposes. Where the purpose is to shape the

strategic behavior of an adversary, the targets are likely to be vulnerabilities that can be exposed and exploited to induce restraint. For these purposes, CONOPS must be developed that generate fear but not reprisal. The point of coercion is to exploit the fear of more to come to induce restraint, not to kill as many as possible. Where the purpose is to achieve an operational outcome, the targets are likely to be those of campaign significance, such as ports and airfields, just as much as forces deployed on the battlefield, with CONOPS developed to cripple key arriving assets.

In fact, there may be a quite simple answer to this question. It may be that CONOPS are not elaborated beyond what the technical system developer elaborates for delivery of the munition in development. If there is weak linkage between the R&D community and the military operator, as there was in many of the BW programs of the 20th century, it may be that CONOPS are quite rudimentary and poorly tailored to the specific tactical or strategic imperatives of the types of wars that may actually occur in the region in the next decade. Of course, their elaboration need not be especially time-consuming.

And which use scenarios stand out as of highest potential impact? The two scenarios explored here (a canonical major theater war and a renewed Iran-Iraq war in 2005) stand out as being potentially the richest in insights for those trying to understand the role of biological weapons in future wars in the region. They focus on actors whose BW capabilities and understanding of BW can be expected to be relatively mature. And they focus on wars in which strategic interests could well drive decision-makers to authorize biological attacks. But this does not make them of the highest potential impact.

The most devastating uses, exploiting the full potential utility of biological weapons to kill millions, would certainly have far-reaching repercussions. They would generate great anxiety within and outside the region, wherever states neighbor others with rumored programs. They would also generate great urgency about "fixing" the BW problem, and the WMD problem more generally. Unless biological weapons use was clearly either as last resort self-defense or as reprisal, it seems likely that the user would become the object of a major international effort to gain his removal. At the very least, there would be pressure on Washington to do

whatever is possible to ensure that such attacks are stopped immediately and definitively.

Arguably, *any* use of biological weapons in the region would have high international impact. It would be seen as setting a dangerous precedent. It also would be seen as another test of the UN Security Council. And it would be seen as the latest challenge to the nonproliferation regime. Finding a way to ensure that the "use" leads to a response that somehow teaches the "right lessons" would likely seem an urgent priority in Washington and elsewhere.

A special kind of importance would attach to a category not so far considered—attacks that might have been prevented or somehow defeated or whose effects could somehow have been minimized if the means had been available to detect and defeat delivery systems and protect against released agent with personal protection systems. In such scenarios, one can imagine a measure of blame falling not just on the perpetrator of the attack but also on those who, in retrospect, are deemed to have failed to take the necessary steps to prevent the attack and minimize its consequences. Thus, there is an argument that a BW attack that is militarily ineffective could still be strategically of great consequence if the simple fact that it was conducted calls into question the value of security relations with the United States.

Notes

1. For an overview of BW proliferation trends see *Proliferation: Threat and Response, 3rd edition* (Washington, DC: Office of the Secretary of Defense, May 2001).

2. This paper distills insights gained over more than a year of research and dialogue on these questions. Preliminary propositions were developed in the autumn of 1999 and refined and validated in 2000 in a series of interactions with experts on the region—experts based in the United States, Europe, and the Middle East. Formal publications on the basic questions are few and far between, so every effort has been made here to uncover areas of consensus and disagreement among analysts and to reflect these in the broader analysis.

3. See Erhard Geissler and John Ellis van Courtland Moon, *Biological and Toxin Weapons: Research, Development and Use from the Middle Ages to 1945* (Stockholm: Oxford University Press for the Stockholm International Peace Research Institute, 1999).

4. Parties in the region include Bahrain, Egypt, Iraq, Iran, Jordan, Kuwait, Lebanon, Libya, Qatar, Saudia Arabia, Syria, Tunisia, United Arab Emirates, Yemen. Of these states parties, some have signed but not ratified. Non-parties include Algeria, Israel, Oman, and Sudan.

5. Such work has been undertaken in associated project activities by the National Defense University and SAIC. See *Motivations to Acquire and Use Biological Weapons in the Middle East*, Science Applications International Corporation, August 24, 2000 (unclassified). See also Jonathan B. Tucker, "Motivations For and Against Proliferation: The Case of the Middle East," in Raymond A. Zilinskas, ed., *Biological Warfare: Modern Offense and Defense* (Boulder, Colo.: Lynne Rienner, 1999), 27-52. For country-specific assessments, see Shahram Chubin, *Eliminating Weapons of Mass Destruction: The Persian Gulf Case* (Washington, DC: Henry L. Stimson Center, March 1997); Joshua Sinai, "Libya's Pursuit of Weapons of Mass Destruction," *Nonproliferation Review* (Spring-Summer 1997), 92-99; Dany Shoham, "Chemical and Biological Weapons in Egypt," *Nonproliferation Review* (Spring-Summer 1998), 48-58; Dany Shoham, "Does Saudia Arabia Have or Seek Chemical or Biological Weapons?" *Nonproliferation Review* (Spring-Summer 1999), 122-129; M. Zuhair Diab, "Syria's Chemical and Biological Weapons: Assessing Capabilities and Motivations," Nonproliferation Review (Fall 1997), 104-111; and Al J. Venter, "New-Era Threat: Iraq's Biological Weapons," Middle East Policy, Vol. 6, No. 4 (June 1999), 104-117.

6. See W. Seth Carus, *"The Poor Man's Atomic Bomb"? Biological Weapons in the Middle East* (Washington, DC: Washington Institute for Near East Policy, 1989), especially chapter 5, "The Effectiveness and Utility of Biological Warfare." See also Brad Roberts, "Between Complacency and Panic: Calibrating the Biological Warfare Threat," in Stuart Johnson, ed., *The Niche Threat: Deterring the Use of Chemical and Biological Weapons* (Washington, DC: National Defense University, 1995).

7. For purposes of the original survey, preliminary research drew on the following sources: *Strategic Survey* and *Military Balance* (prepared as annual surveys by the International Institute for Strategic Studies in London), the annual *Strategic Assessment* prepared by the Institute for National Strategic Studies at the National Defense University, and various publications of the Center for Strategic and International Studies, the Jaffee Center for Strategic Studies at Tel Aviv University, The Nixon Center, RAND, USCENTCOM, and the Washington Institute for Near East Policy. A strawman taxonomy of potential conflicts over the next decade was then developed and tested over a period of months with individual experts.

8. Ahmed Hashim, "The State, Society, and the Evolution of Warfare in the Middle East: The Rise of Strategic Deterrence?" *Washington Quarterly*, Vol. 18, No. 4 (Autumn 1995), 53-72.

9. See Ehud Sprinzak, "On Not Overstating the Problem," and Brian Michael Jenkins, "The WMD Terrorist Threat—Is There a Consensus View?" in Brad Roberts, ed., *Hype or Reality? The "New Terrorism and Mass Casualty Attacks"* (Alexandria, VA.: Chemical and Biological Arms Control Institute, 2000).

10. Simon Whitby and Paul Rogers, "Anti-crop Biological Warfare—Implications of the Iraqi and US Programs," *Defense Analysis*, Vol. 13, No. 3 (1997), 303-318.

11. For a discussion of multiple aspects of the international response to NBC proliferation in the region, see Lawrence Scheinman, "NBC and Missile Proliferation Issues in the Middle East," in Barry Schneider, ed., *Middle East Security Issues In the Shadow of Weapons of Mass Destruction Proliferation* (Maxwell Air Force Base, AL.: Air University Press, 1999).

12. Michael Moodie, *Will Deterrence Work?* (Alexandria, VA.: Chemical and Biological Arms Control Institute, 1998).

13. For an historical perspective on CBW terrorism in the region, with a review of contemporary issues, see Dany Shoham, "Chemical and Biological Terrorism: An Intensifying Profile of a Non-Conventional Threat (Tel Aviv: Ariel Center for Policy Research, 1998).

14. See Brad Roberts, *Biological Weapons in Major Theater War*, IDA Document D-2234 (Alexandria, VA.: Institute for Defense Analyses, November 1998). See also Roberts, "Terrorism and Asymmetric Conflict," in Roberts, ed., *Hype or Reality?*, 147-158.

15. For more on this argument concerning technical challenges, see Karl Lowe, "Analyzing Technical Constraints on Bioterrorism: Are They Still Important?" in Brad Roberts, ed., *Terrorism With Chemical and Biological Weapons: Calibrating risks and Responses* (Alexandria, VA.: Chemical and Biological Arms Control Institute, 1997), 53-64.

16. For more on this argument, see Brian Jenkins, "Understanding the Link Between Motive and Methods," in Roberts, ed., *Terrorism With Chemical and Biological Weapons*, 43-52.

17. Ahmed S. Hashin, "Syria," and Michael Eisenstadt, "Iran," case studies nos. 1 and 2, respectively, in *The Deterrence Series* (Alexandria, VA.: Chemical and Biological Arms Control Institute, 1998).

18. From James K. Campbell, "On Not Understanding the Problem," in Roberts, ed., *Hype Or Reality?*, 19.

19. These latter arguments were made with particular force by Ministry of Defence participants in a project-related symposium on BW in the Middle East in London in June 2000.

20. Jonathan B. Tucker, "Lessons from the Case Studies," in Tucker, ed., Toxic Terror: Assessing Terrorist Use of Chemical and Biological Weapons (Cambridge, MA: MIT Press, 2000), 249-268.

21. Edward M. Spiers, *Chemical and Biological Weapons: A Study of Proliferation* (London: Macmillan Press, 1994), especially chapter 4, "Rabta: A Case Study in International Action," 65-83.

22. Roberts, *Biological Weapons in Major Theater War*.

23. The term "spasm" is Herman Kahn's and is drawn from his analysis of thresholds in the escalation and de-escalation process. See Kahn, *On Thermonuclear War.*

24. For an exploration of the possible escalation and de-escalation dynamics of a major theater war involving the use of weapons of mass destruction, see Brad Roberts, "Rethinking How Wars Must End: NBC War Termination Issues in the Post-Cold War Era," in Victor Utgoff, ed., *The Coming Crisis: Nuclear Proliferation, U.S. Interests, and World Order* (Cambridge, MA.: MIT Press, 2000).

25. For thoughtful insights into these and related topics, see Gregory F. Giles, "The Islamic Republic of Iran and Nuclear, Biological, and Chemical Weapons" in Peter Lavoy, Scott Sagan, and James Wirtz, eds., *Thinking the Unthinkable* (Ithaca, NY: Cornell University Press, 2000).

26.Consideration of precisely how they might be used is the subject of related project work at the Institute for Defense Analyses. See Jeffrey Grotte, Nathan Platt, Doug Schultz, Lynn Yang, "The Impact of Biological Weapons on Future Wars," Institute for Defense Analyses, September 27, 2000.